

Preliminary Classification:

Proposed Class:

Subclass:

NOTE: "All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example "Proposed Class 2, subclass 129." M.P.E.P. § 601, 7th ed.

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application  
Assistant Commissioner for Patents  
Washington, D.C. 20231

## NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

Inventor(s): Marko VALO, Juha RASANEN

WARNING: 37 C.F.R. § 1.41(a)(1) points out:

"(a) A patent is applied for in the name or names of the actual inventor or inventors.

"(1) The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.63, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(i) is filed supplying or changing the name or names of the inventor or inventors."

For (title): METHOD AND APPARATUS FOR DYNAMIC RADIO RESOURCE CONTROLLING

## CERTIFICATION UNDER 37 C.F.R. § 1.10\*

(Express Mail label number is mandatory.)

(Express Mail certification is optional.)

I hereby certify that this New Application Transmittal and the documents referred to as attached therein are being deposited with the United States Postal Service on this date September 15, 1999, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EL336861169US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Maureen Egan

(type or print name of person mailing paper)

Signature of person mailing paper

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

"WARNING: Each paper or fee filed by "Express Mail" must have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).

"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

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09/15/99



JCS96 U.S. PTO

JCS96 U.S. PTO

09/29/2000



66/61/6/6

09/29/2000 00:15:39

## 1. Type of Application

This new application is for a(n)

(check one applicable item below)

- ☒ Original (nonprovisional)  
☐ Design  
☐ Plant

**WARNING:** Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. § 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

**WARNING:** Do not use this transmittal for the filing of a provisional application.

**NOTE:** If one of the following 3 items apply, then complete and attach **ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED** and a **NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION**.

- ☐ Divisional.  
☐ Continuation.  
☐ Continuation-in-part (C-I-P).

## 2. Benefit of Prior U.S. Application(s) (35 U.S.C. §§ 119(e), 120, or 121)

**NOTE:** A nonprovisional application may claim an invention disclosed in one or more prior filed copending nonprovisional applications or copending international applications designating the United States of America. In order for a nonprovisional application to claim the benefit of a prior filed copending nonprovisional application or copending international application designating the United States of America, each prior application must name as an inventor at least one inventor named in the later filed nonprovisional application and disclose the named inventor's invention claimed in at least one claim of the later filed nonprovisional application in the manner provided by the first paragraph of 35 U.S.C. § 112. Each prior application must also be:

(i) An international application entitled to a filing date in accordance with PCT Article 11 and designating the United States of America; or

(ii) Complete as set forth in § 1.51(b); or

(iii) Entitled to a filing date as set forth in § 1.53(b) or § 1.53(d) and include the basic filing fee set forth in § 1.16; or

(iv) Entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(f) within the time period set forth in § 1.53(f).

37 C.F.R. § 1.78(a)(1).

**NOTE:** If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach **ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED**.

**WARNING:** If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. §§ 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. §§ 120, 121 or 365(c). (35 U.S.C. § 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. §§ 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.



- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

**5. Declaration or oath (including power of attorney)**

**NOTE:** A newly executed declaration is not required in a continuation or divisional application provided that the prior nonprovisional application contained a declaration as required, the application being filed is by all or fewer than all the inventors named in the prior application, there is no new matter in the application being filed, and a copy of the executed declaration filed in the prior application (showing the signature or an indication thereon that it was signed) is submitted. The copy must be accompanied by a statement requesting deletion of the names of person(s) who are not inventors of the application being filed. If the declaration in the prior application was filed under § 1.47, then a copy of that declaration must be filed accompanied by a copy of the decision granting § 1.47 status or, if a nonsigning person under § 1.47 has subsequently joined in a prior application, then a copy of the subsequently executed declaration must be filed. See 37 C.F.R. §§ 1.63(d)(1)-(3).

**NOTE:** A declaration filed to complete an application must be executed, identify the specification to which it is directed, identify each inventor by full name including family name and at least one given name, without abbreviation together with any other given name or initial, and the residence, post office address and country or citizenship of each inventor, and state whether the inventor is a sole or joint inventor. 37 C.F.R. § 1.63(a)(1)-(4).

- ☒
- Enclosed

Executed by

(check all applicable boxes)

- ☒ inventor(s).
- ☐ legal representative of inventor(s).  
37 C.F.R. §§ 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.
- ☐ This is the petition required by 37 C.F.R. § 1.47 and the statement required by 37 C.F.R. § 1.47 is also attached. See item 13 below for fee.

- ☐
- Not Enclosed.

NOTE: Where the filing is a completion in the U.S. of an International Application or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

- ☐ Application is made by a person authorized under 37 C.F.R. § 1.41(c) on behalf of *all* the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 C.F.R. § 1.16(e) can be filed subsequently).

- ☐ Showing that the filing is authorized.  
(not required unless called into question, 37 C.F.R. § 1.41(d))

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## 6. Inventorship Statement

**WARNING:** If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.

The inventorship for all the claims in this application are:

☐ The same.

or

☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,

☐ is submitted.

☐ will be submitted.

## 7. Language

**NOTE:** An application including a signed oath or declaration may be filed in a language other than English. An English translation of the non-English language application and the processing fee of \$130.00 required by 37 C.F.R. § 1.17(h) is required to be filed with the application, or within such time as may be set by the Office. 37 C.F.R. § 1.52(d).

☒ English

☐ Non-English

☐ The attached translation includes a statement that the translation is accurate. 37 C.F.R. § 1.52(d).

## 8. Assignment

☒ An assignment of the invention to Nokia Mobile Phones Limited

☒ is attached. A separate ☒ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

☐ will follow.

**NOTE:** "If an assignment is submitted with a new application, send two separate letters—one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

**WARNING:** A newly executed "CERTIFICATE UNDER 37 C.F.R. § 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.

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**9. Certified Copy**

Certified copy(ies) of application(s)

Country	Appln. No.	Filed
Finland	982002	September 16, 1998
Country	Appln. No.	Filed
Finland	982643	December 7, 1998
Country	Appln. No.	Filed

from which priority is claimed

☒ Is (are) attached.☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 C.F.R. § 1.55(e) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. § 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

**10. Fee Calculation (37 C.F.R. § 1.16)**A. ☒ Regular application

CLAIMS AS FILED			
Number filed	Number Extra	Rate	Basic Fee 37 C.F.R. § 1.16(a) \$760.00
Total			
Claims (37 C.F.R. § 1.16(c))	11 - 20 = 0	× \$ 18.00	
Independent Claims (37 C.F.R. § 1.16(b))	2 - 3 = 0	× \$ 78.00	
Multiple dependent claim(s), if any (37 C.F.R. § 1.16(d))		+ \$260.00	

☐ Amendment cancelling extra claims is enclosed.☐ Amendment deleting multiple-dependencies is enclosed.☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 C.F.R. § 1.16(d).

Filing Fee Calculation \$760.00

B. ☐ Design application  
(\$310.00—37 C.F.R. § 1.16(f))

Filing Fee Calculation \$

C. ☐ Plant application  
(\$480.00—37 C.F.R. § 1.16(g))

Filing fee calculation \$

11. Small Entity Statement(s)

- ☐ Statement(s) that this is a filing by a small entity under 37 C.F.R. § 1.9 and 1.27 is (are) attached.

**WARNING:** "Status as a small entity must be specifically established in each application or patent in which the status is available and desired. Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. The refiling of an application under § 1.53 as a continuation, division, or continuation-in-part (including a continued prosecution application under § 1.53(d)), or the filing of a reissue application requires a new determination as to continued entitlement to small entity status for the continuing or reissue application. A nonprovisional application claiming benefit under 35 U.S.C. § 119(e), 120, 121, or 365(c) of a prior application, or a reissue application may rely on a statement filed in the prior application or in the patent if the nonprovisional application or the reissue application includes a reference to the statement in the prior application or in the patent or includes a copy of the statement in the prior application or in the patent and status as a small entity is still proper and desired. The payment of the small entity basic statutory filing fee will be treated as such a reference for purposes of this section." 37 C.F.R. § 1.28(a)(2).

**WARNING:** "Small entity status must not be established when the person or persons signing the . . . statement can unequivocally make the required self-certification." M.P.E.P., § 509.03, 6th ed., rev. 2, July 1996 (emphasis added).

(complete the following, if applicable)

- ☐ Status as a small entity was claimed in prior application \_\_\_\_\_ / \_\_\_\_\_, filed on \_\_\_\_\_, from which benefit is being claimed for this application under:

35 U.S.C. § ☐ 119(e),  
☐ 120,  
☐ 121,  
☐ 365(c),

and which status as a small entity is still proper and desired.

- ☐ A copy of the statement in the prior application is included.

Filing Fee Calculation (50% of A, B or C above)

\$ \_\_\_\_\_

**NOTE:** Any excess of the full fee paid will be refunded if small entity status is established and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136, 37 C.F.R. § 1.28(a).

12. Request for International-Type Search (37 C.F.R. § 1.104(d))

(complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made at This Time

☐ Not Enclosed

☐ No filing fee is to be paid at this time.  
(This and the surcharge required by 37 C.F.R. § 1.16(e) can be paid subsequently.)

☒ Enclosed

☒ Filing fee \$ 760.00

☒ Recording assignment  
(\$40.00; 37 C.F.R. § 1.21(h))  
(See attached "COVER SHEET FOR  
ASSIGNMENT ACCOMPANYING NEW  
APPLICATION".) \$ 40.00

☐ Petition fee for filing by other than all the  
inventors or person on behalf of the inventor  
where inventor refused to sign or cannot be  
reached  
(\$130.00; 37 C.F.R. §§ 1.47 and 1.17(i)) \$

☐ For processing an application with a  
specification in  
a non-English language  
(\$130.00; 37 C.F.R. §§ 1.52(d) and 1.17(k)) \$

☐ Processing and retention fee  
(\$130.00; 37 C.F.R. §§ 1.53(d) and 1.21(l)) \$

☐ Fee for international-type search report  
(\$40.00; 37 C.F.R. § 1.21(e)) \$

NOTE: 37 C.F.R. § 1.21(f) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 C.F.R. § 1.53(f) and this, as well as the changes to 37 C.F.R. §§ 1.53 and 1.78(a)(1), indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(f) must be paid, within 1 year from notification under § 53(f).

Total fees enclosed \$ 800.00

14. Method of Payment of Fees

☒ Check in the amount of \$ 800.00

☐ Charge Account No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_

A duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid, 37 C.F.R. § 1.22(b).



# 15. Authorization to Charge Additional Fees

**WARNING:** If no fees are to be paid on filing, the following items should *not* be completed.

**WARNING:** Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

- ☒ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 16-1350:

☒ 37 C.F.R. § 1.16(a), (f) or (g) (filing fees)

☒ 37 C.F.R. § 1.16(b), (c) and (d) (presentation of extra claims)

**NOTE:** Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

☒ 37 C.F.R. § 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☒ 37 C.F.R. § 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a)).

☐ 37 C.F.R. § 1.17 (application processing fees)

**NOTE:** "... A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

**NOTE:** Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

**NOTE:** 37 C.F.R. § 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . the issue fee. . . ." From the wording of 37 C.F.R. § 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

16. Instructions as to Overpayment

NOTE: "... Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

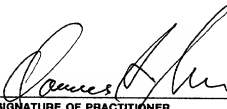
- ☒ Credit Account No. 16-1350  
☐ Refund

SEND ALL CORRESPONDENCE TO:

Reg. No. 24,622

Tel. No. (203) 259-1800

Customer No.



SIGNATURE OF PRACTITIONER

Clarence A. Green

(type or print name of attorney)

PERMAN & GREEN, LLP

P.O. Address

425 Post Road, Fairfield, Connecticut 06430

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☐ **Incorporation by reference of added pages**

*(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)*

- ☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added \_\_\_\_\_

- ☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added \_\_\_\_\_

- ☐ Plus added pages deleting names of inventor(s) named in prior application(s) who is/are no longer inventor(s) of the subject matter claimed in this application.

Number of pages added \_\_\_\_\_

- ☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added \_\_\_\_\_

☒ **Statement Where No Further Pages Added**

*(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item)*

- ☒ This transmittal ends with this page.

## METHOD AND APPARATUS FOR DYNAMIC RADIO RESOURCE CONTROLLING

### FIELD OF THE INVENTION

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The present invention relates to a method for communicating with a mobile network element and a mobile terminal implementing the method. The mobile terminal comprises transmission means for communicating with a mobile network element using a bearer that is modifiable by a negotiation between the mobile terminal and the mobile network element, said data being divided into data units that comprise at least one user data element and at least one status data element, said status data element optionally comprising a status indication from the mobile network element to the mobile terminal.

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### 15 BACKGROUND OF THE INVENTION

Many existing digital wireless or mobile telephone networks make use of time division multiple access (TDMA) to share out radio resources between a number of mobile stations and between a number of channels. For example, in the European Telecommunications Standards Institute (ETSI) GSM standard, a given frequency band is divided in the time domain into a succession of frames, known as TDMA (Time Division Multiplexed Access) frames. The length of a TDMA frame is 4.615ms. Each TDMA frame is in turn divided into eight consecutive slots of equal duration. In the conventional circuit switched transmission mode, when a call is initiated, a full rate bi-directional traffic channel (TCH/F) is defined for that call by reserving two time slots (1 to 8), in each of a succession of TDMA frames, for the duration of the call. One of these slots provides the downlink from the base station (BS) to the mobile station (MS) whilst the other provides the uplink.

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The circuit switched transmission mode in GSM provides for a data transmission rate of 9.6kbps. However, due to the demand for higher transmission rates, a set of GSM enhancements known as GSM Phase 2+ have been specified by ETSI. One of the main features of GSM Phase 2+ is known as High Speed Circuit

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Switched Data (HSCSD - specified in GSM 02.34 and GSM 03.34) which achieves an increased data transmission rate by using more than one TCH/F for a single connection (i.e. effectively reserving two or more consecutive time slots in each TDMA frame).

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In GSM HSCSD non-transparent connection mode the user can (if the MS supports this feature) request service level up- or downgrading, i.e. request more or less time slots to be allocated for a connection. Provided that the feature is requested in the set-up of a call, service level up- and downgrading is possible during an ongoing call. For example, when setting up a connection to an Internet Service Provider (ISP), the login and authorisation procedures do not require a lot of transmission capacity and could therefore be managed with one time slot connection. When the connection is established and a large file or a www-page (World Wide Web) containing graphics is being downloaded, more transmission capacity is needed. When the file or the www-page are downloaded and the user is reading the information, the need for capacity is not that big anymore, and a small number of time slots are needed.

The advantage of using a correct amount of capacity, i.e. correct number of time slots at each time draws from the fact that the user pays for the connection depending on the amount of time slots used. The less capacity is used, i.e. the less time slots are wasted, and the less the user has to pay. In addition, this approach is advantageous also with respect to the network, since the same resources can be used to facilitate services for a remarkably larger number of users.

However, until now the initiative of radio resource modification (e.g. capacity) is left to the user, which means that in order to be able to properly utilise said radio resource modification, the user should be able to perform relatively complicated call control procedures. On the other hand, the protocols between a mobile station and network entities have been quite definitely specified in the standards, and any new solutions for easier assessment of radio resource modification that require

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changes to existing standards and/or to existing mobile network elements are not very satisfactory.

- Furthermore, to facilitate such up- or downgrading of service level, also the application running in the MS must be adapted to support this feature. This means that for example, a www-browser or an email application in the MS must be adapted to recognise that the connection used is a GSM connection employing multiple time slots, and that service level up- and downgrading is supported by the mobile. So far no such applications exist, and even if some such applications were created, mobile subscribers would always be limited to those few adapted applications available.

#### SUMMARY OF THE INVENTION

- Now, a method and a device have been invented, with which the effect of these problems can be considerably reduced.

- According to the first aspect of the invention the mobile terminal comprises detecting means for detecting a need for bearer modification from received status indications in at least two consecutive data units; and control means for initiating a negotiation for bearer modification, as a response to the detected need for bearer modification.

- In the solution according to the invention, the mobile terminal is arranged to analyse the received data flow, and using the existing information therein to decide whether a correct radio resource is used for the transmission or not. If the radio resource is insufficient, the mobile terminal will initiate negotiations for radio resource upgrading. If the radio resource is excessive, the mobile terminal will initiate negotiations for radio resource downgrading.

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Consequently, radio resource modifications can be implemented automatically without the user or the data processing entity connected to the MS necessarily

being involved with the control of the properties of the radio resource. Accordingly, the present invention enables easy utilisation of the dynamic nature of the data link.

- 5 According to a second aspect of the invention a method for communicating with a mobile network element is presented. The method comprises communicating with a mobile network element using a bearer that is modifiable by a negotiation between the mobile terminal and the mobile network element. The data is divided into data units that comprise at least one user data element and at least one
- 10 status data element, said status data element optionally comprising a status indication from the mobile network element to the mobile terminal. The method is characterized by detecting a need for bearer modification from received status indications in at least two consecutive data units; and initiating a negotiation for bearer modification, as a response to the detected need for bearer modification.

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## BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the

20 accompanying drawings, in which;

Figure 1 illustrates the basic elements of the GSM system (state of the art);

Figure 2 illustrates a generalised implementation of HSCSD services in the GSM network (state of the art);

Figure 3 illustrates an example of the signalling in GSM HSCSD, associated with

25 the user initiated service level up- and downgrading procedure (state of the art);

Figure 4 illustrates the functional elements of the data transfer process in GSM (state of the art);

Figure 5 illustrates the structure of a RLP frame;

Figure 6 illustrates an example of a L2R Packet Data Unit (PDU);

- 30 Figure 7 illustrates the functionality of a MS according to the invention;

Figure 8 illustrates an embodiment for controlling the radio transmission in the downlink direction; and

Figure 9 illustrates functional modules of a mobile terminal according to the invention.

#### DETAILED DESCRIPTION

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The invention will, by way of an example, be described in connection with GSM (Global System for Mobile Telecommunications) system using the terms and elements traditionally appearing in this context. Further embodiments in functionally equivalent mobile communication system environments are naturally possible. Among the preferred systems are, for example, GSM derivatives, like DCS (Digital Cellular System for 1800 MHz) and PCS (Personal Communications Service for 1900 MHz).

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Figure 1 illustrates the basic elements of the GSM system. Mobile stations MS are in connection with base stations BTS using radio communication. The base stations BTS are further, through a so-called Abis interface, connected to a base station controller BSC, which controls and manages several base stations. The entity formed by several base stations BTS and a single base station controller BSC controlling them are called a base station sub-system BSS. Particularly, the base station controller BSC manages radio-communication channels, as well as handovers. On the other hand, the base station controller BSC is, through the so-called A interface, in connection with a mobile services switching centre (MSC), which co-ordinates the establishment of connections to and from mobile stations. Through the mobile services switching centre MSC, a connection can further be established to a subscriber not operating under the mobile communication network.

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A set of GSM enhancements specified by European Telecommunications Standards Institute (ETSI) is called ETSI Phase 2+. One of the main work items in phase 2+ is High Speed Circuit Switched Data (HSCSD). HSCSD is an enhancement of the current circuit switched GSM data services to cover higher user rates than 9.6 kbps. The architecture of the HSCSD service is based on the

30



physical layer of the current data services. The increased data rate is achieved by using a combination of more than one full traffic channel (TCH/F) for a single connection.

- 5 In the transparent data transmission mode the maximum HSCSD data rate is 64 kbps using bit transparent protocols. In non-transparent mode the maximum data rate is 38.4 kbps achieved by using a combination of four TCH/F9.6 channels. After the standardisation of the 14.4 kbps channel coding is completed, the maximum non-transparent data rate is increased to 57.6 kbps. The effective user
- 10 data rate of the non-transparent HSCSD data service may be further increased by using GSM data compression that is based on V.42bis algorithm. This compression algorithm increase the effective user data rate to between two and four times the physical user data rate.
- 15 Non-transparent mode of HSCSD is realised by modifying the RLP (Radio Link Protocol) and L2R (Layer 2 Relaying ) functions to support multiple parallel traffic channels (TCH/F) instead of only one TCH/F, and the RLP frame numbering is increased to accommodate the enlarged data transmission rate, as specified by the ETSI and generally known to a person skilled in the art. Figure 2 illustrates a
- 20 generalised implementation of HSCSD services in the GSM network. In addition to the network elements described in connection of Figure 1, a new functionality IWF (Inter-Working Function) is introduced in the network side and TAF (Terminal Adapter Function) in a mobile station. The new elements provide the functions of combining and splitting the data into separate data streams, which will then be
- 25 carried via n channels at the radio interface. Once split, the data streams shall be carried by the n full rate traffic channels, called HSCSD channels, as if they were independent of each other, for the purpose of data relay and radio interface error control, until to the point in the network where they are combined.
- 30 To couple the Terminal Adapter Function with Interworking control procedures, a group of GSM Bearer Capability Information Elements (BCIE) need to be defined during the call set-up procedure. The BCIE comprise a parameter User Initiated

Modification Indication (UIMI), which is relevant between the MS and IWF. The value of UIMI indicates whether the user would like to be able to modify the value of maximum number of traffic channels during a connection, and in positive case also the maximum number of time slots available for upgrading the connection.

- 5 Among parameters negotiated in the call set-up procedure are also the Fixed Network User Rate (FNUR), which defines the user rate between the IWF and the fixed network, and the Wanted Air Interface User Rate (WAIUR) defining the air interface user rate between the MS and IWF.
- 10 If the parameter UIMI has been given a non-zero value, during a HSCSD call the user may request the network to change the current maximum number of traffic channels and air interface user rate parameters. Figure 3 illustrates an example of the signalling in GSM HSCSD, associated with the user initiated service level up- and downgrading procedure. The user will initiate the procedure with a signal 3.1
- 15 comprising the new parameters *para* defining the radio resource wished for. If the network allows the modification, the resulting new parameters are forwarded to the BSC (signal 3.2) and the radio interface resources may be adjusted accordingly. The resource upgrading and downgrading are done separately from the change in HSCSD parameters. However, if a contradiction between the new
- 20 parameters and the used air interface resources exists, the resource downgrading may be needed before the network acknowledges the new parameters. When the procedure is finished, the BSC will acknowledge it to the MSC (signal 3.3) and the MSC will indicate the completion of the modification to the MS (signal 3.4).
- 25 In the system according to the embodiment of the invention, the mobile station monitors the data flow transferred over the air interface, and based on the monitoring results intelligently controls e.g. the number of the time slots used for the connection. In the following, some embodiments of the invention are discussed. The radio resource used for a connection is hereafter referred to as a
- 30 bearer.

According to the invention the data already available in data units is used by the MS to derive the decision whether bearer modification is necessary. To demonstrate the structural division of transceived information, data transfer process in a GSM system supporting HSCSD service is studied. Figure 4

5 illustrates the functional elements of the data transfer process in GSM. Data from the Data Terminal Equipment DTE is processed by Layer 2 Relay function L2R, which provides for the reliable transportation of known, i.e. non transparent, user protocols across the radio interface of a GSM PLMN. The L2R uses the services provided by the Radio Link Protocol (RLP) to transport the non-transparent  
10 protocol information between the MS and the network. In Figure 5 an example of a RLP frame 50 is shown. The frame typically comprises a header 51, an information field 52 and a frame check sequene 53. The information of L2R data units is carried in the information field 52 of the frame.

15 The decision on whether a correct radio resource is used could also be made in the IWF and be indicated to the MS in the header 51 of the RLP frame. Anyhow, this seems to be an unnecessary association between a link layer protocol and a non-link-layer function, and as conceivably bringing about some changes to the protocol, would not be very satisfactory.

20 In Figure 6 as an example of a data unit, a structure of a L2R Packet Data Unit (PDU) is illustrated. It comprises consecutive octets that are data octets 61 carrying user data and status octets 62 carrying general information on the contents of the PDU and/or the status of the connection.

25 The L2R and RLP entities have buffers which may become full to a predetermined threshold for a number of reasons, e.g. severe radio fading, failure or slowness of DTE to react to end-to to-end flow control, or certain RNR conditions. When this predetermined threshold is reached, a flow control active condition is sent to the associated DTE, which is then prevented from sending any data. Subsequently,  
30 the flow control inactive condition is sent to the associated DTE when the L2R or RLP entities have indicated that there is sufficient free capacity in their buffers for

data flow from the associated DTE to proceed. A status octet 62 of a L2R PDU comprises a flow control indication bit 63 indicating whether the flow control in the DTE in the opposite end is active or inactive. A status octet may also comprise a break indication bit indicating that the rest of the PDU is empty, i.e. the PDU is not full of user data.

In the solution according to the invention, the user has an opportunity to enable or disable the use of user initiated bearer modification. When the modification is enabled, the mobile station according to the invention starts monitoring the contents of the consecutively received data units, here the L2R PDUs. In the first embodiment of the invention, the MS will especially monitor consecutively received flow control indication bits. Whenever it seems that the flow control in the IWU end is active for a long period, the MS deduces that the data rate should be downgraded and initiates a bearer downgrading negotiation. If the flow control is not active or has not been active for some time, the MS will initiate a radio resource upgrading negotiation. The decision, on when the flow control is active or inactive for a long time, i.e. when the bearer modification (upgrading or downgrading) in this case is necessary, can be derived in many ways. Next one of the possible ways is described.

The flow chart of Figure 7 illustrates the functionality of a MS according to the invention from the beginning of a set-up of a call or from the acknowledged bearer modification. In step 710 the reference value R equalling to the value of the received status bit Flbit (Flow control Indication bit) that indicates the activity or inactivity of the flow control in the IWU, is initialised. In step 715 the counter CT, which is used for storing the number of consecutive Flbits having the same value, is initialised. After this the first PDU is received (step 720), and the value of Flbit is checked (step 725). The received value Flbit is compared with the reference value R (steps 730, 735), and if they are not the same, the reference value R will be changed (step 770). If the Flbit is the same as the reference value R, the counter CT is incremented (steps 740). The derived counter value CT is compared (steps 745, 750) with the threshold value CTmax that indicates the maximum number of

consecutive flow control indication bits that are detected before the initiation of bearer modification. If the counter value is less than or equal to CTmax, the process will continue from step 720 where the next PDU is received. If the counter value CT is greater than CTmax, the MS will initiate a negotiation for a bearer modification, as described earlier (step 760).

The embodiment of Figure 7 is an example of a solution according to the invention. It applies well for controlling the radio transmission in the uplink direction. Anyhow, as mentioned earlier, the interval of consecutive indication of flow control before initiation of bearer modification can be implemented in many ways. For example, a timer that is initialised each time the value of the flow control indication bit changes can be used. It is also possible to use different threshold values for bearer upgrading and downgrading. For example, bearer upgrading can be initiated after a number of consecutive bits that indicate the Flow control inactive –status, and bearer downgrading can be initiated after a number of consecutive bits that indicate the Flow control active –status.

The flow chart of Figure 8 illustrates an embodiment for controlling the radio transmission in the downlink direction. The PDUs comprise information indicating whether the PDU is full or not. By monitoring such information, it is possible to derive an estimate on the effective transmitted user data rate. If the effective user data rate is substantially less than the full capacity of the used channels, the MS will initiate bearer downgrading. If, on the other hand, the effective user data rate corresponds to the full capacity of the used channels, the MS will try data rate upgrading. The effective user data rate can be derived in several ways, but in the following an embodiment using two simple counters and a timer is described.

The RLP-header of a PDU comprises a S-bit that indicates whether the PDU comprises a status octet or not. Status octets are inserted in the character stream whenever a status change needs to be transmitted. If the PDU is full of data, it does not comprise the status octet. In the embodiment the effective user data rate is derived in predefined intervals T. This means that a timer  $t$  is running for a

period of  $T$  at a time and after the elapse of the time limit  $T$ , the estimation of effective user data rate is restarted. In step 810 two counters  $SE$  and  $SF$  are initialised, and in step 815 the timer  $t$  is started. In step 820 the count of the timer  $t$  is checked, and whenever the time limit  $T$  has elapsed, the process will go to step 845. Until the time limit  $T$  has elapsed, a next PDU will be received (step 825) and the indication  $Sbit$ , indicating whether the PDU comprises a status octet or not, is checked (step 830). If in step 835 the  $Sbit$  indicates that the PDU does not comprise a status octet, the counter  $SF$  is incremented (step 840). If the  $Sbit$  indicates that PDU comprises a status octet, the contents of the PDU has to be checked more thoroughly (step 860). The status octet comprises status bits  $SA$ ,  $SB$  and  $X$ , and a 5-bit code which indicates the location of the next status octet or that the remainder of the PDU is empty. If the indication of the remainder of the PDU being empty is found (step 865), the counter  $SE$  is incremented (step 870), otherwise no incrementation is done. After step 865 = No or after step 870 the process will continue from step 820. Alternatively the step 865 = No could go to step 840 (not shown in the Figure).

When at step 820 it is noted that the time limit  $T$  has elapsed, it continues at step 845 in which the current value of the counter  $SF$  is divided with the reading  $t$  of the timer to derive the rate  $sf$  at which PDUs that are full of user data are received. Moreover, at step 875 the current value of the counter  $SE$  is divided with the reading  $t$  of the timer to derive the rate  $se$ . Then it is checked if the derived value of  $sf$  is greater than a predefined threshold  $TH1$  (step 850), and if so the MS will initiate a bearer upgrading process (step 855). If  $sf$  is not greater than a predefined threshold  $TH1$  another comparison is made (at step 880) to see if the derived value of  $se$  is greater than a predefined threshold  $TH2$ , and if so the MS will initiate a bearer downgrading process. If the threshold  $TH1$  or  $TH2$  is not exceeded, the process will continue from step 810.

Figure 9 illustrates functional modules of mobile terminal according to the invention. A Central Processing Unit 91 controls the blocks responsible for the mobile station's different functions: a Memory (MEM) 92, a Radio Frequency block

(RF) 93, a User Interface (UI) 94 and an Interface Unit (IU) 95. CPU is typically implemented with one or more functionally inter-working microprocessors. The memory preferably comprises a ROM (Read Only Memory), a RAM (Random Access Memory) and is generally supplemented with memory supplied with the

5 SIM User Identification Module. In accordance with its program, the microprocessor uses the RF block 93 for transmitting and receiving messages on the radio path. Communication with the user is managed with by the UI 94, which typically comprises a loudspeaker, a display and a keyboard. The Interface Unit 95 provides a link to a data processing entity, and it is controlled by the CPU 91.

10 The data processing entity may be an integrated data processor or external data processing equipment. The mobile terminal according to the invention further comprises detection means 96 for monitoring the contents of the received data flow, and based on a certain predefined property in the data flow will detect whether the current bearer is adequate or not. The means may comprise at least

15 one counter that is incremented by consecutive flow control indications, as described in connection with Figure 6. The means may also comprise one or more counters responsive to the indication of full or partly full PDUs, and a timer, as described in connection with Figure 9. Other functionally equivalent means are also possible. Though shown as a separate element in Figure 9, the means may

20 also be integrated within the CPU. By utilising said detection means 96 the mobile terminal is able to automatically control the capacity used for the connection and thereby enhance the effective use of bearer.

The above is a description of the realization of the invention and its embodiments

25 utilizing examples. It is self evident to a person skilled in the art that the invention is not limited to the details of the above presented embodiments and that the invention can be realized also in other embodiments without deviating from the characteristics of the invention. The presented embodiments should be regarded as illustrating but not limiting. Thus the possibilities to realize and use the

30 invention are limited only by the enclosed claims. Thus different embodiments of the invention specified by the claims, also equivalent embodiments, are included in the scope of the invention.

## CLAIMS

1. A mobile terminal (MS) comprising
  - 5       transceiving means (TAF, 93) for communicating data with a mobile network element (IWF) using a bearer that is modifiable by a negotiation between the mobile terminal (MS) and the mobile network element (IWF), said data being divided into data units (60) that comprise at least one user data element (61) and at least one status data element (62), said status data  
10       element (62) comprising a status indication (63) from the mobile network element (IWF) to the mobile terminal (MS);  
          wherein said mobile terminal (MS) further comprises  
              detecting means (96) for detecting a need for bearer modification from received status indications (63) in at least two consecutive data units; and  
15       control means (91) for initiating a negotiation for bearer modification, as a response to the detected need for bearer modification.
2. A mobile terminal as claimed in claim 1, wherein the transceiving means (TAF, 93) is arranged to transceive data units (60) in information fields (52) of frames  
20       (50) transmitted over the air interface.
3. A mobile terminal as claimed in claim 2, wherein the frames (50) are transmitted over the air interface in consecutive TDMA data frames, and the bearer modification comprises modification of the amount of time slots in  
25       consecutive TDMA frames assigned for the transmission between the mobile terminal (MS) and the mobile network element (IWF).
4. A mobile terminal as claimed in claim 3, wherein the bearer modification is either of the following: bearer upgrading and bearer downgrading.



5. A mobile terminal as claimed in claim 1, wherein the mobile terminal is a GSM terminal supporting HSCSD service and the mobile network element being the Inter-Working Function (IWF) of the Mobile Switching Center (MSC).
- 5 6. A mobile terminal as claimed in claim 1, wherein said status indication (53) comprises an indication (F1bit) of flow control, when the flow control is active in the mobile network element (IWF), and said detecting means (96) being responsive to said indication (F1bit) of flow control.
- 10 7. A mobile terminal as claimed in claim 5, wherein said detecting means (96) comprises a counter (CT) arranged to be incremented as a response to a data unit (60) that comprises said indication (F1bit) of flow control and is preceded by a data unit (60) that also comprises said indication (F1bit) of flow control.
- 15 8. A mobile terminal as claimed in claim 6, wherein the control means (91) is arranged to initiate a negotiation for bearer downgrading, as a response to the reading of the counter (CT) exceeding a predefined threshold (TH1).
9. A mobile terminal as claimed in claim 1, wherein the status indication (53) is an ending indication (Sbit) included in the data unit (60) whenever the data unit (60) is not full of data.
- 20 10. A mobile terminal as claimed in claim 1, wherein said means for detecting comprises at least one counter (SE) arranged to be incremented at least as a response to the data unit (60) comprising said ending indication (Sbit), and at least one timer (t).
- 25 11. A method for communicating with a mobile network element (IWF), comprising: communicating data with a mobile network element (IWF) using a bearer that is modifiable by a negotiation between the mobile terminal (MS) and the mobile network element (IWF), said data being divided into data units (60) that
- 30 comprise at least one user data element (61) and at least one status data

element (62), said status data element (62) comprising a status indication (63) from the mobile network element (IWF) to the mobile terminal (MS);

wherein the method further comprises

5 detecting a need for bearer modification from received status indications (63) in at least two consecutive data units; and

initiating a negotiation for bearer modification, as a response to the detected need for bearer modification.

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## ABSTRACT

A method and a mobile terminal for communicating with a mobile network element (IWF) comprising communicating with a mobile network element (IWF) using a bearer that is modifiable by a negotiation between the mobile terminal (MS) and the mobile network element (IWF). The data is divided into data units (60) that comprise at least one user data element (61) and at least one status data element (62), said status data element (62) optionally comprising a status indication (63) from the mobile network element (IWF) to the mobile terminal (MS). A need for bearer modification is detected from received status indications (63) in at least two consecutive data units; and a negotiation for bearer modification is initiated, as a response to the detected need for bearer modification.

(Figure 6)

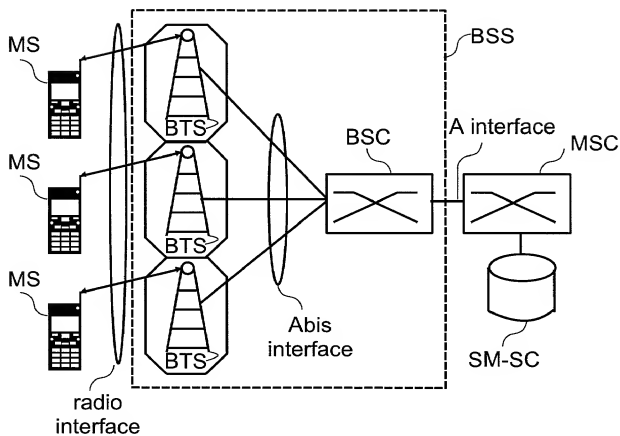


FIG 1

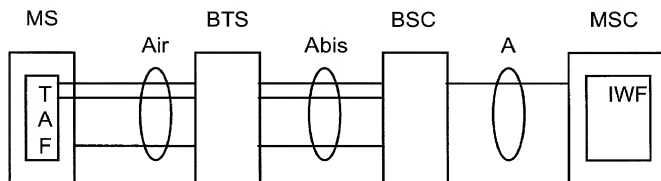


FIG 2

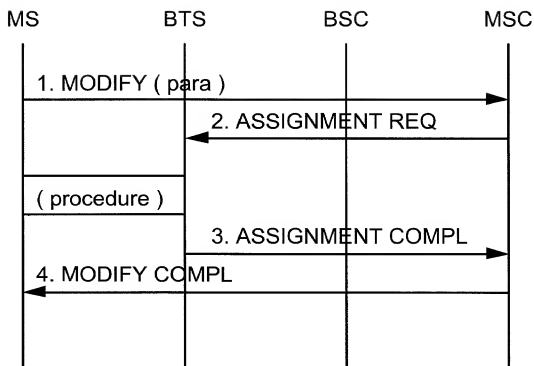


FIG 3

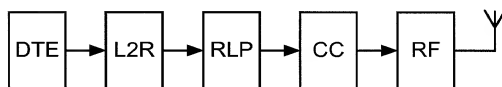


FIG 4

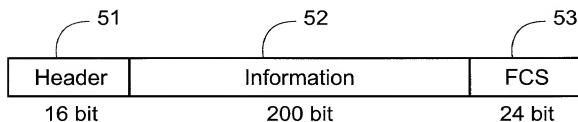


FIG 5

	8	7	6	5	4	3	2	1	
0	SA	SB	x	0	0	0	1	1	62
1	1	1	0	0	0	1	1	1	
2	1	1	0	1	0	0	1	1	
3	1	1	0	0	1	1	0	1	61
4	SA	SB	x	1	1	1	1	1	
									60
⋮									
⋮									
n-1									

FIG 6

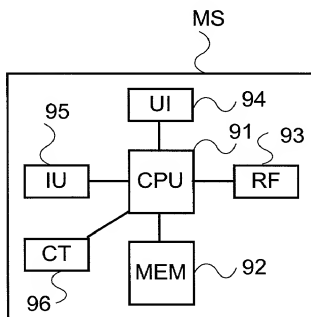


FIG 9

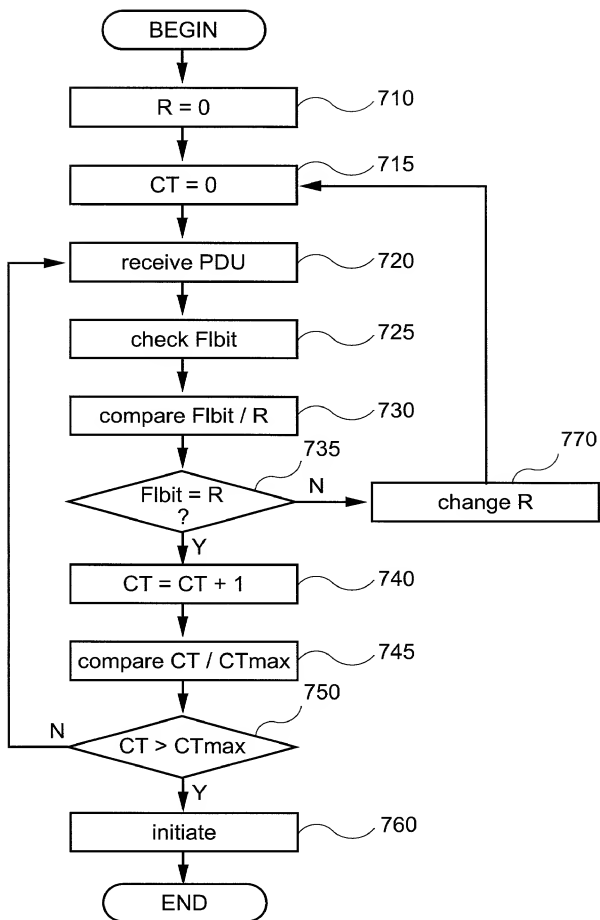


Fig. 7

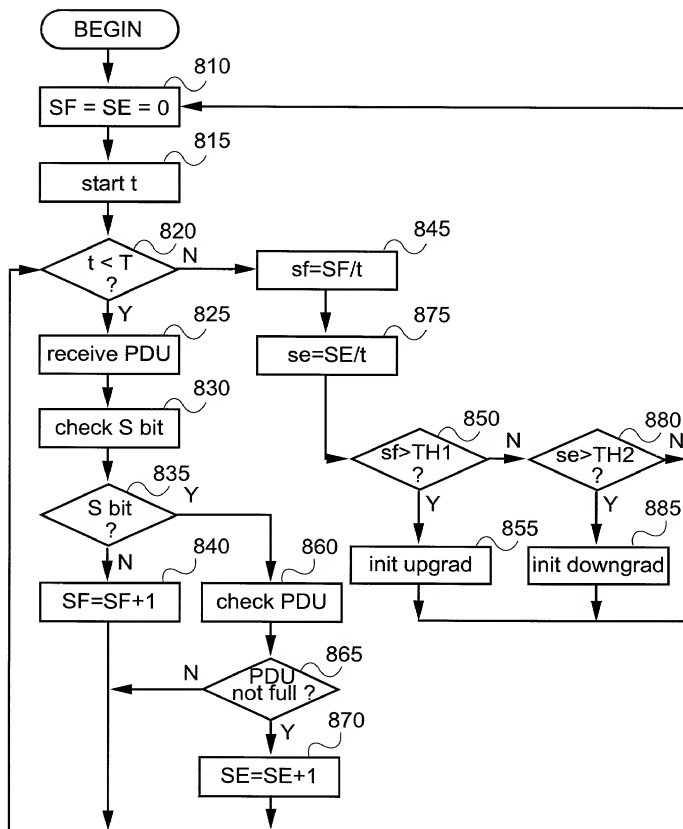


Fig. 8



## COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,  
CONTINUATION OR C-I-P)

As a below named inventor, I hereby declare that:

## TYPE OF DECLARATION

This declaration is of the following type: (check one applicable item below)

- ☒ original  
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- ☐ national stage of PCT

NOTE: if one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.

- ☐ divisional  
☐ continuation  
☐ continuation-in-part (C-I-P)

## INVENTORSHIP IDENTIFICATION

**WARNING:** If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below next to my name.  
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

## TITLE OF INVENTION

**Method and apparatus for dynamic radio resource controlling**

## SPECIFICATION IDENTIFICATION

the specification of which: (complete (a), (b) or (c))

- (a) ☒ is attached hereto.  
(b) ☐ was filed on \_\_\_\_\_ as ☐ Serial No. 0 /  
or ☐ Express Mail No., as Serial No. not yet known  
and was amended on \_\_\_\_\_ (if applicable)

NOTE: Amendments filed after the original papers are deposited with the PTO which contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

- (c) ☐ was described and claimed in PCT International Application No. \_\_\_\_\_ filed on \_\_\_\_\_ and as amended under PCT Article 19 on \_\_\_\_\_ (if any).

#### ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information

- ☒ which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56  
(also check the following items, if desired)

- ☒ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent, and

- ☐ In compliance with this duty there is attached an information disclosure statement in accordance with 37 CFR 1.98.

#### PRIORITY CLAIM (35 U.S.C. § 119)

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT International application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT International application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

- (d) ☐ no such applications have been filed.
- (e) ☒ such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

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AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119**

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
Finland	982002	16 September 1998	<input checked="" type="checkbox"/> YES      NO <input type="checkbox"/>
Finland	982643	7 December 1998	<input checked="" type="checkbox"/> YES      NO <input type="checkbox"/>
			<input type="checkbox"/> YES      NO <input type="checkbox"/>
			<input type="checkbox"/> YES      NO <input type="checkbox"/>
			<input type="checkbox"/> YES      NO <input type="checkbox"/>

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(6) MONTHS FOR DESIGN PRIOR TO THIS U.S. APPLICATION**

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**POWER OF ATTORNEY**

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(List name and registration number)*

Clarence A. Green (24,622)  
Harry F. Smith (32,493)  
Mark F. Harrington (31,686)

*(check the following item, if applicable)*

- ☐ Attached as part of this declaration and power of attorney is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO

Perman & Green  
425 Post Road  
Fairfield, CT 06430-6232

DIRECT TELEPHONE CALLS TO:

(Name and telephone number)

Mark F. Harrington

(203) 259-1800

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name as it should appear on the filing receipt and all other documents.

Full name of sole or first inventor

Marko

(GIVEN NAME)

(MIDDLE INITIAL OR NAME)

VALO

FAMILY (OR LAST NAME)

Inventor's signature

Date AUGUST 23, 1999

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Inventor's signature

Date August 23, 1999

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(GIVEN NAME)

(MIDDLE INITIAL OR NAME)

FAMILY (OR LAST NAME)

Inventor's signature \_\_\_\_\_

Date \_\_\_\_\_ Country of Citizenship

Residence

Post Office Address

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incapacitated inventor. *Number of pages added*  
...
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- ☐ Added page for signature by one joint inventor on behalf of deceased inventor(s)  
where legal representative cannot be appointed in time (37 CFR 1.47).  
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- ☐ Added pages to combined declaration and power of attorney for divisional, continuation, or  
continuation-in-part (C-I-P) application. ☐ Number of pages added  
...
- ☐ Authorization of attorney(s) to accept and follow instructions from representative.  
...

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check the following item:)

☒ This declaration ends with this page.

(Declaration and Power of Attorney [1-1]-page 5 of 5)